Antlers

Improving Deer Velvet Profitability through New Technology

(a FRST project NOD401)

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1. Introduction

As the deer industry has focused its venison production on 12 to 15 month old animals, it has become increasingly important to select for future antler production at an earlier age.

In addition, the emphasis in marketing velvet antler has been for more of the A & B grades, rather than the lower grades.

The harvest of spiker velvet antler is also now more common, for velvet extract and for a developing sliced velvet market. As well as being removed to meet market demands, there is also a need to avoid animal welfare concerns and remove the spiker velvet prior to transporting the young stags to the Deer Slaughter Premises.

Past research has shown that using the velvet weight of the animal as an indicator of later velvet production potential, is reasonably accurate only once the animals are two years of age or older.

Those farmers who have attempted to cull yearling stags have used body weight as one of their main selection criteria. They have used body weight in the absence of any research to find a suitable alternative. The result is that many farmers report that using body weight as a selection method means that they end up keeping a large number of animals that in future years will produce low quality and low quantity velvet.

From one farmer "trial", it had been suggested that there could be better indicators of future velvet production.

This project was proposed to "test" this farmer experience over several herds and was designed to run for three seasons looking at spiker, 2-year-old and 3-year-old velvet. The project commenced in September of 1995 and will be completed by July 1998.

2. Methodology

2.1 Demonstration Farm

A trial herd of approximately 140 yearling stags was chosen where the stags were to be managed uniformly and to come from a known genetic background. The herd selected was farmed by David Collie and located at Four Peaks, Geraldine.

In addition to this demonstration farm, a further seven herds were selected to record and contribute farm production data on body weight and velvet production.

2.2 Trial Design

This study used 140 rising one-year-old red stags on the trial property. This group was to be retained until 36 months of age with detailed recording of body weights, velvet antler growth patterns and individual antler measurements.

The rising one-year-stags on the other seven properties were an unselected group of stags, managed similarly. Detailed records of body weights, velvet antler growth patterns and individual antler measurements WERE made. Given that these were commercial velvet operations, it was not possible to retain the total group until they were 36 months of age as FOR the trial property. Four of the properties managed to retain their total group until velvet harvest at 2 years of age, at which time stags were culled. On the other 3 properties, a culling option was taken for some stags at 15 months of age.

Year 1 - Spiker Antler Growth

To get the maximum value from the resource herd, one antler was harvested under standard conditions of analgesia and/or anaesthetic at growth of a standard height of 20 to 30 cm (from the skull).

The remaining antler was allowed to develop to full length and calcify, and removed following stripping in the "hard" antler form (late January/February). Both antlers were labeled and stored for later measurement and analysis at Invermay.

Each antler was randomly selected for treatment.

On the other seven properties, both left and right antlers were harvested at the same stage of velvet antler growth (20 to 30 cm). At the time of removal, each antler was individually identified and the following measurements recorded:

Spike velvet antler:

Date of harvest
TL total length from skull to tip of antler
PC circumference of pedicle
Wt body weight on date of velvet harvest

Once the velvet had been frozen, the following measurements were made and recorded:

VL length of the cut antler
TC circumference of the top of the antler
TCL length from TC measurement to tip of antler
NC circumference of mid beam
NCL length from NC measurement to base of antler

BC	circumference around the base of antler
BCL	length from BC measurement to base of antler
Wt	weight of each antler to nearest 1 gram

Spike hard antler:

	date of removal
Wt1	body weight at time of hard antler removal
HL	length of hard antler spike
Wt2	weight of hard antler spike

Year 2- Two year old velvet measurements:

	date of casting of left and right "button"
	date of antler harvesting
Wt1	body weight at time of velvet harvest
TL	length from base of skull to antler tip
PC	circumference of pedicle
VL	length of antler
MC	mid beam circumference between bez and trez tyne
MCL	length from MC measurement to the tip of the antler
TRC	beam circumference above the trez tyne
TRCL	length from TRC measurement to the tip of the antler
TC	circumference of the top of the antler
TCL	length from TC measurement to the tip of the antler
N	length from beam junction to tip of brow tyne
S	length from beam junction to tip of trez tyne
Wt2	weight of antler to nearest 5 grams

Year 3 - three year old velvet measurements:

	date of casting of left and right "button"
	date of antler harvesting
VL	length of harvested antler
MC	mid beam circumference between bez and trez tyne
	grade of each antler to 1997 GIB standards
Wt	weight of antler to nearest 5 grams

2.3 Chemical analysis

Year 1(1995):

Both velvet antlers and the hard spike from Collie's herd was taken for further analysis at Invermay AgResearch Centre, Mosgiel.

Year 2 & 3 (1996 &7):

The antler corresponding to the side selected for the velvet harvest at spiker stage was taken for further analysis at Invermay.

3. Interim Results

The project still has some time to run. In particular there are as yet no details from the year 3 stage (three year old velvet). The following is therefore only a preliminary examination of the data collected thus far.

The data summaries used here are provided from Interim Reports "Improved Culling of Stags NOD401" authors Jim Webster, Ian Corson & Jimmy Suttie, AgResearch, Invermay, September & November 1997.

One property was not considered for analysis due to the low numbers of stags involved on that property.

3.1. Mean values of main parameters and differences between farms

There were significant differences in all the main parameters measured between the farms. The means are listed below.

Cutting date in Year 1 (CD1)

Farm	1	2	3	4	5	6	7
CD1	27-Jan-96	23-Jan-96	30-Jan-96	23-Jan-96	18-Nov-95	7-Jan-96	25-Dec-95
Grand mean	6-Jan-96	Significant difference between farms P < 0 001					

Live weight at Cutting in Year 1 (LWT1)

Farm	1	2	3	4	5	6	7
LWT1 (kg)	92	101	95	88	87	98	95
Grand mean	93	Significant difference between farms P < 0 001					

Antler weight in Year 1 (AWT1)

Farm	1	2	3	4	5	6	7
AWT1 (g)	156	133	170	134	142	153	151
Grand mean	149	Significant difference between farms P < 0.001					

Total antler length in Year 1 (TL1)

Farm	1	2	3	4	5	6	7
TL1 (mm)	263	260	289	258	276	279	268
Grand mean	271		Significant difference between farms P < 0 001				

Velvet antler length in Year 1 (VL1)

Farm	1	2	3	4	5	6	7
VL1 (mm)	192	184	198	209	215	196	194
Grand mean	200		Significant difference between farms P < 0 001				

Top circumference in Year 1 (TC1)

Farm	1	2	3	4	5	6	7
TC1 (mm)	113	103	119	102	102	113	114
Grand mean	110		Significant difference between farms P < 0 001				

Middle circumference in Year 1 (MC1)

Farm	1	2	3	4	5	6	7
MC1 (mm)	95	89	97	88	87	92	93
Grand mean	92		Significant difference between farms P < 0 001				

Bottom circumference in Year 1 (BC1)

Farm	1	2	3	4	5	6	7
BC1 (mm)	107	104	102	94	105	100	104
Grand mean	102		Significant difference between farms P < 0.001				

Pedicle circumference in Year 1 (PCIRC1)

Farm	1	2	3	4	5	6	7
PC1 (mm)	109	105	118	99	103	106	107
Grand mean	106		Significant difference between farms P < 0 001				

Antler weight in Year 2 (AWT2)

Farm	1	2	3	4	5	6	7
AWT2 (g)	550	562	649	540	696	721	670
Grand mean	638		Significant difference between farms P < 0 001				

3.2. Relationship between Year 1 parameters and Year 2 antler weight

Using data from all farms, middle circumference in Year 1 came out as the best predictor of Year 2 antler weight. Adding the Year 1 parameters, total antler length and live weight improved the prediction of Year 2 antler weight.

Parameter	estimate	standard error	P	variation explained
MC1	4 74	32	< 001	15 5%
TL1	0 37	09	< 001	1 7%
LWT1	1 28	41	<0.01	0 6%

Analysis of data from individual farms showed the best predictor of Year 2 antler weight varied between farms. Middle circumference was a good predictor on farms 3 and 7 and antler weight on farms 1 and 2 was the best predictor for Year 2 velvet weight.

Farm	1	2	3	4	5	6	7
Constant	235 6	183.8	-497 9	287.1	762	117	-8 6
Significance	P<0 001	P<0 05	P<0.001	P<0.01	P<0 001	NS	P<0.001
Main parameter	AWT1	AWT1	MC1	AWT1	PCIRC1	MC1 3 65	MC1 7.85
Estimate Variation	0.83	1 10	7 13	0 58	-1 98	6 5%	28 9%
Significance	37.7%	21 7%	40 3%	9 6%	1 3%	P<0.01	P<0 001
	P<0 001	P<0 001	P<0 001	P<0 01	P<0 05		
Second parameter	TC1	LW1	PCIRC1	LWT1	LWT1 1.6	PCIRC1	PCIRC1
Estimate Variation	1 63	2 30	3.85	1.78	0.2%	2 32	8 05 10.6%
Significance	4 1%	2.9%	5.2%	1.7% NS	NS	1.5%	P<0 001
	P<0.001	P<0.05	P<0.001			NS	

3.3 Correlation between Year 1 middle circumference and Year 2 antler weight

Assuming that MC1 was used as the criteria for culling 50% of a herd, the percentage of Year 2 antlers that were common to the top 50% in both MC1 and AWT2 were 51-89% as shown in the following table:

Farm	1	2	3	4	5	6	7
#Year 1 antlers	204	133	316	386	312	384	417
#Year 2 antlers	198	129	308	111	303	118	318
% common	66	60	70	89	51	83	58

It should be noted that significant numbers of antlers (animals) were absent in Year 2 from farms 4, 6 and 7 so the above result is likely to be biased on these farms depending on the nature of the data that is missing.

4. CONCLUSION OF ALL HERD DATA ANALYSIS

This initial analysis has shown that the relationship between Year 1 antler and Year 2 antler weight varies with farm. Overall it points to middle circumference as being the most reliable predictor for early culling of stags for velvet production.

5. Further Data Analysis

This analysis is restricted to data collected from the farm of Dave Collie (Trial herd). On this farm, in Year 1, one side was cut in velvet (Spiker 1) and the other side was left to harden. This has allowed a comparison of velvet vs hard antler measurements in Year 1 to predict Year 2 antler weight. It has also allowed an analysis of the effect of cutting velvet antler in Year 1, on the subsequent growth and measurements of that antler in Year 2. This is achieved by comparing Year 2 measurements of the side that was left to go hard in Year 1 with the side that was cut in Year 1.

5.1 Materials And Methods

Correlation of hard antler parameters with Year 2 antler weight was done using stepwise linear regression.
Differences in Year 2 parameters between the hard antler side and the velvet antler side in Year 1 were detected by analysis of variance.

5.2 Results

5.2.1. Comparison of velvet vs hard antler parameters in predicting Year 2 antler weight

Measurements which were made on velvet antler in Year 1 predicted velvet antler weight in Year 2 better than measurements made on hard antler from Year 1. Velvet antler weight, mid-circumference and base-circumference were the best measures, and explained more of the variation in Year 2 antler weight than the corresponding hard antler measures.

5.2.2. Culling Predictions based on velvet antler

The effects of culling in Year 1 using various measurements, on the percentage of animals retained that were in either the top 10%, 20%, 30%, 40% or 50% of velvet weight producers in Year 2 is shown in the Figures 1, 2 and 3. Note that Figure 3 has a different scale. Figure 1 represents culling at 50%, Figure 2, at 60% and Figure 3 at 70% of the herd in Year 1. From these figures it seems likely that 7 - 8 out of 10 of the top-producing animals would be retained when culling at around 50 to 60% using either middle circumference or antler weight in Year 1. If culling rate is increased to 70% however, the result was no better than random selection and pedicle circumference appeared to be a worse predictor than random selection. The drop off in retention of top animals when culling rate is increased to 70% using middle circumference is shown in Figure 4.

Previous analysis on the farm of Dave Collie, indicated that velvet antler weight in Year 1 was the best predictor of Year 2 antler weight, followed by live weight at cutting. However, of the antler parameters only, middle circumference was the second best predictor on The Dave Collie farm and was the best predictor of Year 2 antler weight across all the farms. Over all the culling rates tested, there was no difference in the average number of animals retained (6.9 out of 10) between using antler weight or middle circumference on the Dave Collie farm.

5.2.3. *Effect of leaving antler to go hard in Year 1 on velvet antler parameters in Year 2*

Total antler length, middle circumference, bottom circumference, and antler weight were all less ($P<0.001$) for hard antler than for velvet antler in Year 1.

A comparison of measurements made on Year 2 antler between the side that was cut as velvet in Year 1 vs the side that was left to go hard in Year 1 indicates that total antler length, pedicle circumference, velvet antler length, antler weight, middle circumference, brow tine length and trez tine length were all greater on the side that had been left to go hard as shown in the following table:

Mean and s.e.d. of measurements made on Year 2 antler between the side that was cut as velvet in Year 1 vs the side that was left to go hard in Year 1.

Parameter	Hard side Year 1	Velvet side Year 1	s.e.d.	P
Total length (mm)	358	353	1 4	<0.001
Pedicle circumference (mm)	113	109	0 4	<0 001
Velvet length (mm)	309	303	1 7	<0 001
Middle circumference (mm)	120	119	0 5	<0 05
Brow tine length (mm)	168	164	1 9	<0.05
Trez tine length (mm)	53	48	1.7	<0.01
Antler weight (g)	586	563	4.3	<0.001

5.3 Conclusions On Collie Herd Analysis

Culling predictions suggest that a culling rate of around 50% using middle circumference of the velvet antler in Year 1 should leave a good proportion of top-producing animals in Year 2 in the herd. Cutting the antler in Year 1 reduced many aspects of antler size in Year 2. Analysis of Year 3 data may indicate whether this difference persists or is of financial relevance. However, as velvet measurements were better predictors of Year 2 antler than those of hard antler, one possible scenario for top-producing stags would be to make the culling decision on a middle circumference measurement of velvet in Year 1, then leave the antler to harden before removal to maximise antler size in Year 2 or beyond

Acknowledgments

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Figure 1

Percentage of top-producing animals retained in Year 2 when culling 50% of the herd using various Year 1 characteristics.

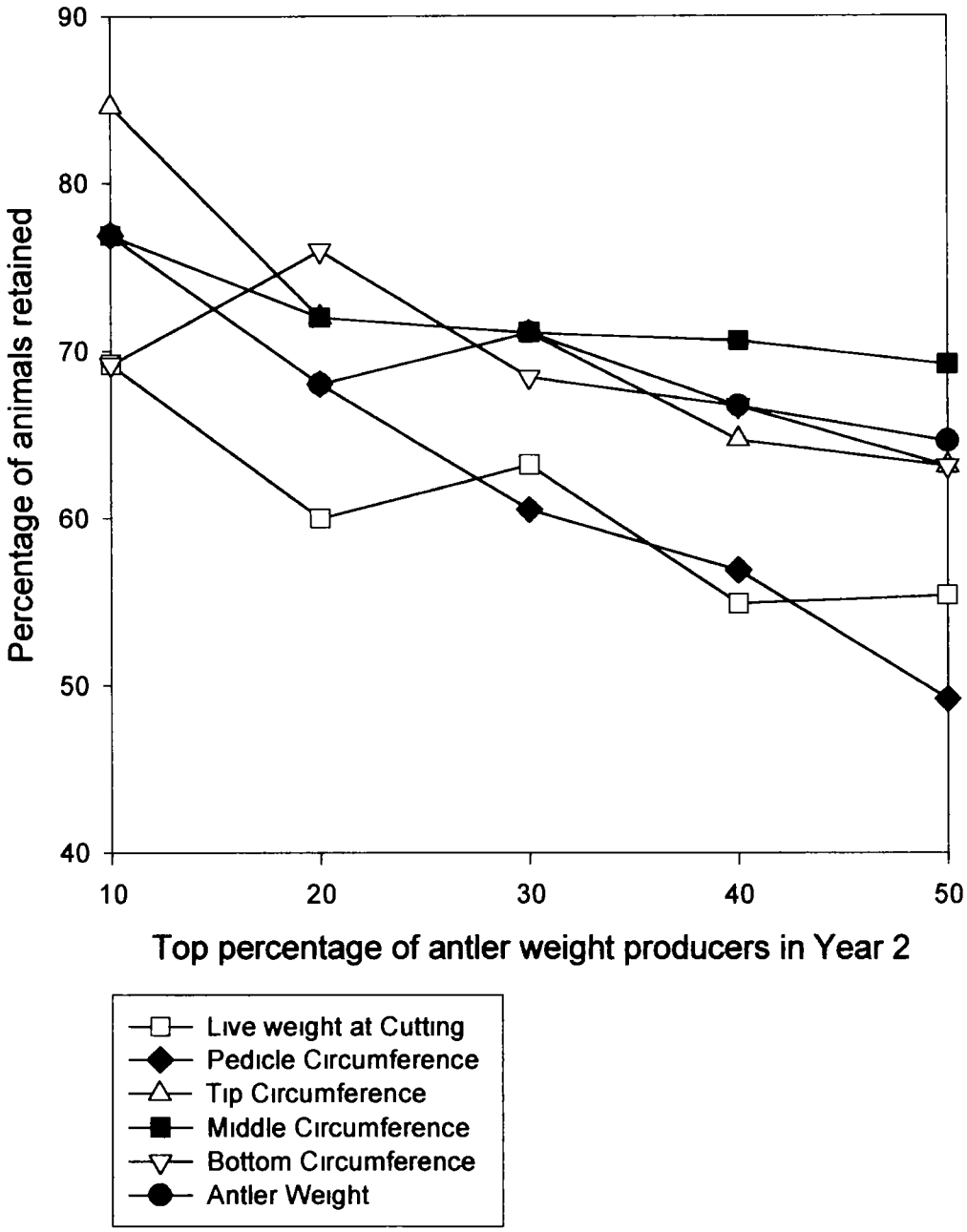

Figure 2

Percentage of top-producing animals retained in Year 2 when culling 60% of the herd using various Year 1 characteristics.

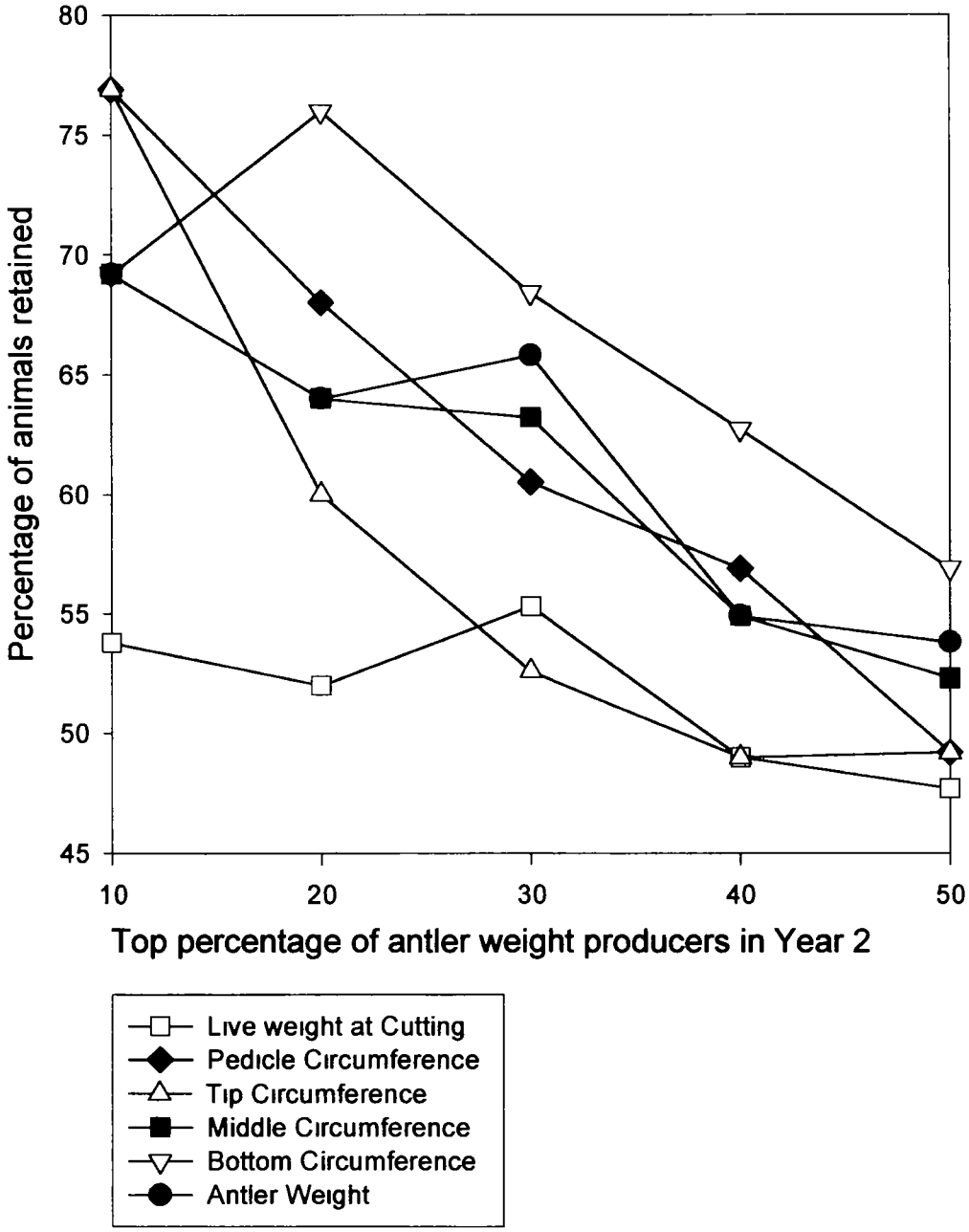

Figure 3

Percentage of top-producing animals retained in Year 2 when culling 70% of the herd using various Year 1 characteristics.

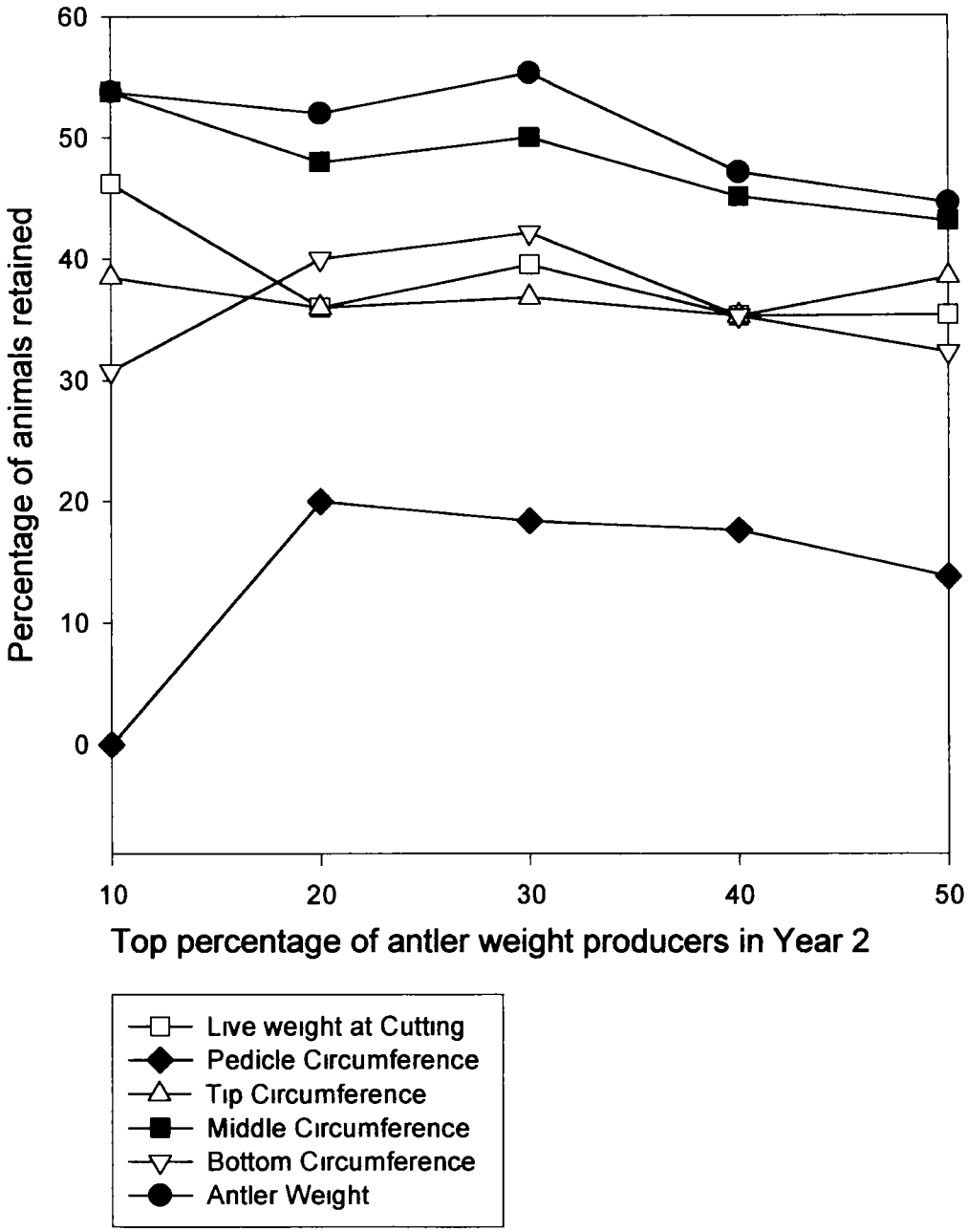

Figure 4

Effect of culling at various rates using middle circumference in Year 1 on the percentage of top producing animals in Year 2 retained.